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## SECTION III.—FORECASTS.

## FORECASTS AND WARNINGS FOR FEBRUARY, 1917.

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[Dated: Weather Bureau, Washington, D. C., Mar. 20, 1917.]

During February, 1917, 12 well-defined lows were charted, and of these 4 were of the Alberta, 3 of the North Pacific, 2 of the South Pacific, 1 of the northern Rocky Mountains region, and 2 of the Central type. Eleven highs crossed the United States, and of these 10 belonged to the Alberta type, and the other one had its origin on the eastern slope of the Rocky Mountains. The highs and lows of the month exceeded the average in speed of movement, and the highs in nearly all instances were well defined and many of them were of exceedingly high pressure with decided cold waves attending them. A marked feature in connection with the highs was that all save one were of the Alberta type, while the lows belonged to five types, no one of which was predominant.

In the Alaskan area the pressure was above the normal at the beginning of the month and again after the 15th. Moreover, pressure above the normal prevailed over southeastern Alaska continuously during the month. Over the Aleutian Islands and northwestern Alaska the pressure was below the normal generally from the 3d to the 14th, inclusive. At Honolulu the pressure was below the normal from the 1st to the 6th and from the 15th to the 22d, but above the normal on other days except the 14th, the 26th, and the 27th. Over the western North Atlantic the pressure was near or slightly above the normal in the vicinity of Grand Turks and Bermuda, and decidedly below the normal off the coast of Newfoundland.

Because of the marked activity of highs and lows during the month storm and cold-wave warnings were necessitated on many days. The prominent cold waves of the month occurred during the first decade and caused much damage to growing crops in the South Atlantic and Gulf States.

## WASHINGTON DISTRICT.

*Cold-wave warnings during February.*—The severe cold wave which had reached the Mississippi Valley by the night of January 31 overspread the entire eastern half of the country during February 1–3. On the latter date the temperature fell to 16° at Jacksonville and below freezing throughout the Florida peninsula, Miami reporting 28°, the lowest of record at that station. This was the most severe freeze in Florida since February, 1899. Cold-wave warnings had been issued on January 30 and 31 for all sections east of the Mississippi River, except northern New England. On February 1 warnings were issued for northern New England and were repeated for all other States east of the Mississippi except upper Michigan. The following forecast was issued for Florida:

Partly cloudy and decidedly colder to-night and Friday. Severe cold wave in north portion to-night and in the peninsula Friday; probably freezing temperature Friday night to central Florida.

On the 2d the following forecast was issued for the same State:

Fair and colder to-night; severe cold wave in central and southern portions of the peninsula; temperature of 20° to 25° in central portion and close to freezing in extreme south portion.

The cold-wave warnings were also repeated for South Carolina and eastern and central North Carolina on the morning of the 2d.

During the night of February 3–4 a disturbance developed over the North-Central States and was central over southern Michigan at 8 a. m. of the 4th as a storm of marked intensity. At the same time an area of high pressure of great magnitude was advancing rapidly south-eastward over the Northwestern States and the Plains States with the highest barometer reading 31.08 inches at Miles City, Mont. Cold-wave warnings were issued for all States east of the Mississippi River except upper Michigan, the western and northern portions of southern Michigan, northern New England, western New York, and Florida. Special afternoon reports showing a rapid decrease in pressure over the Southeastern States, warnings were issued for northern and central Florida. At 9:30 p. m. of the 4th warnings were issued for western New York and northern New England. These warnings were fully verified in nearly all sections except northern New England and New York. In Florida the warning was partially verified; however, freezing temperature and killing frost were reported as far south as Miami on the morning of the 6th.

On the evening of February 7 a disturbance was advancing eastward over the Lakes Region followed by a marked increase in pressure and much lower temperature over Manitoba and North Dakota. Cold-wave warnings were issued for the northern portion of northern New England, the interior of eastern New York, northern and western portions of Pennsylvania, western New York, Ohio, Indiana, and Michigan. On the following morning these warnings were extended over Kentucky, Tennessee, and West Virginia. On the 9th warnings were issued for southern New England, eastern New York, the Middle Atlantic States, the Carolinas, southern and extreme eastern Georgia, and extreme northeastern Florida. Warnings were also issued of frost or freezing temperature to the coast in Mississippi and Alabama, and frost in Florida to the 27th parallel. Practically all of the warnings issued on the 7th, 8th, and 9th were fully verified.

Pressure was falling over the South Atlantic and East Gulf States on the morning of the 11th, with abnormally high pressure and cold weather to the north and northwest. As it appeared probable that the pressure would rise with a considerable fall in temperature over the Southeastern States, cold-wave warnings were issued for southwestern Virginia, eastern Tennessee, the Carolinas, northern Georgia, Alabama, southern and central Mississippi, and frost warnings for southern Georgia and extreme northern Florida. These warnings were verified in Mississippi, were partially verified in Alabama and eastern Tennessee, and failed in the other States on ac-

count of cloudy weather continuing and northeasterly winds setting in.

Frost warnings that were issued on February 15 for the southern portions of Alabama and Mississippi, northwestern Florida, and southwestern Georgia were partially verified.

A storm of marked intensity moving rapidly eastward was central over Lake Superior on the morning of the 17th and was followed by a decided increase in pressure over Minnesota and the Dakotas. Therefore cold-wave warnings were issued on February 18 for Michigan, Indiana, Ohio, northwestern Pennsylvania, and western and extreme northern New York, and for the northern portions of Maine, New Hampshire, and Vermont. These warnings were fully verified only in Michigan and northern New England and were partially verified in New York. The high-pressure area moved directly eastward over the northern Lakes Region instead of southeastward as expected, so that the warnings south of the Great Lakes failed of verification.

There was a decided decrease in pressure during the night of February 22-23 over the Lakes Region, the Ohio Valley, and Tennessee, with a marked rise in pressure and much colder weather over the Plains States and the Missouri Valley. Cold-wave warnings were issued on the 23d for Michigan, Indiana, the western portions of Kentucky and Tennessee and northwestern Ohio, and on the 24th for the northern portions of Maine and Vermont. These warnings were verified only in upper Michigan, the northern portion of southern Michigan, and the northern portions of Maine and Vermont. During the remainder of the month no cold-wave warnings were issued except on the 27th for northern Vermont and extreme northern New York.

*Storm warnings during February, 1917.*—The storm warnings which were ordered on January 31 on the Gulf coast from Bay Saint Louis, Miss., to Cedar Keys, Fla., and on the Atlantic coast from Eastport to Jacksonville were continued on February 1 and were extended to Tampa on the west Florida coast and southward to Jupiter on the east coast. Warnings were again ordered continued on the 2d from Provincetown, Mass., to Jupiter, Fla., and were extended to Key West on account of the strong gradient over the Gulf of Mexico and the South Atlantic States. These warnings were fully verified, the highest velocity reported being 60 miles an hour from the northwest at Jacksonville, Fla., Savannah, Ga., and Block Island, R. I., during the 2d. On the morning of the 3d the warnings were continued from Sandy Hook, N. J., to Provincetown, Mass., westerly gales continuing until the morning of the 4th. On this morning a disturbance of marked intensity was centered over southern Michigan, moving rapidly eastward with a strong high-pressure area to the westward. Northwest storm warnings were ordered displayed from Eastport to Wilmington, and, afternoon special reports showing a marked decrease in pressure over the Southeastern States, northwest warnings were ordered displayed at 4 p. m. along the Gulf coast from Bay Saint Louis to Tampa, and were extended on the Atlantic coast southward from Wilmington to Jupiter. On the 5th the warnings were continued along the Atlantic coast from Hatteras to Eastport, the storm center being over Connecticut with a barometer reading of 28.96 inches at Hartford. These warnings were fully verified, the highest velocity reported being 72 miles an hour from the northwest at Block Island, while velocities of 60 to 68 miles an hour were reported from several points along the coast from Hatteras northward.

A storm of marked intensity was central over New Jersey on the morning of the 9th, with a strong gradient to the westward. Anticipating a further development of this storm northwest storm warnings were ordered at 10 a. m. from Eastport to Hatteras and were fully verified, the highest velocity reported being 64 miles an hour from the northwest at New York. The warnings were continued until sunset on the 10th, from Eastport to Sandy Hook.

On the morning of the 15th a disturbance was central over eastern Tennessee, with lowest pressure 29.64 inches. The 12-hour and 2-hour pressure changes, indicating an increase in the intensity of this storm, northeast storm warnings were ordered at 11 a. m. from Nantucket to New York and northwest warnings from Sandy Hook to Savannah. Northeast warnings were ordered at 3 p. m. along the New England coast north of Nantucket. While the storm increased in intensity as anticipated, the pressure did not increase materially in its rear, so that no high velocities were reported, except 56 miles an hour from the northwest at New York.

A barometric depression of great depth was advancing rapidly southeastward over the western Canadian Provinces on the morning of the 16th, and special reports from Minnesota during the day showing rapidly falling barometer over that State, the following advisory warning for Lake Michigan was issued at 4 p. m.:

Increasing southeast to south winds, becoming strong and probably reaching gale force by Saturday morning. Storm of marked intensity moving rapidly southeastward toward Lake Michigan.

During the night of the 16-17th a velocity of 40 miles an hour from the southwest was recorded at Ludington, Mich., and 44 miles an hour at Green Bay, Wis. By 8 a. m. of the 17th the storm center was over Lake Superior, with a barometer reading of 29 inches at Marquette, Mich. Southwest storm warnings were ordered displayed at noon from Eastport to Delaware Breakwater, but the storm decreased greatly in intensity during the day and only fresh winds were reported along the North Atlantic coast.

On the morning of the 23d the pressure was high over the North Atlantic States, with a decided fall in pressure over the lower Lakes Region and the Ohio Valley. Southwest storm warnings were ordered from Delaware Breakwater to Eastport, but the only winds of gale force reported were 36 miles an hour at Portland, Me., and 40 miles at Nantucket Lightship.

A storm of marked intensity was central over the Lakes Region on the morning of the 26th, moving rapidly eastward, and southwest storm warnings were ordered displayed at 10 a. m. along the Atlantic coast from Delaware Breakwater to Eastport. These warnings were verified along the New England coast, the highest velocity reported being 52 miles an hour from the southwest at Nantucket.—*Charles L. Mitchell, Assistant Forecaster.*

#### WARNINGS FROM OTHER DISTRICTS.

*Chicago district.*—The cold weather of the closing days of January persisted, in the Chicago district, with more or less modification during the greater portion of the month, but there were a few warm days during the third decade.

The barometer was high and the cold intense in the Canadian northwest practically until the close of the month, so that the lows from the west were forced to take the central and southerly routes in passing eastward

from the Pacific. One after another of these LOWS crossed the country in rapid succession, causing a temporary rise in the temperature in the Middle States to be followed in turn by cold weather. At the same time the falls in temperature were not at all times general over the Rocky Mountains Region and the Eastern slope, because of the persistency of the Plateau HIGH during the first half of the month, and of the Pacific LOW during the latter period.

At the beginning of the month the temperature was not only unusually low but the pressure high in the northwest. A reading of 31.14 inches was noted at Battleford, while pressures exceeding 31 inches prevailed generally throughout Alberta and eastern Montana. The temperature at the same time was below zero as far south as Oklahoma and as far east as the middle Mississippi Valley. In anticipation of these extreme conditions warnings had been issued in the closing days of January.

Cold-wave warnings, more or less general, were issued on February 3, 16, and 17, while on February 7, 8, 10, 22, 25, and 26 they were ordered for limited areas. For the most part the limiting temperature required for verification was reached, except in the third decade following the period of abnormally high temperature with decided falls, without, however, reaching the low point.

Advices were sent to the stock interests to protect their cattle on the western ranges on February 17, 20, and 22, as the cold promised to be ushered in with strong winds and some snow.

Because of the rapid movement of the LOWS, the attendant precipitation was slight and mostly confined to the northern portion of the district. Drought continued in the Central Plains States with only slight interruption until the close of the month, and but little precipitation was forecast for that section.—*H. J. Cox, Professor of Meteorology.*

*New Orleans district.*—The month opened with a severe cold wave for which timely warnings had been issued. The temperature was 26° along the West Gulf coast on the morning of February 2. Another decided cold wave overspread the district on the 4th and 5th, for which timely warnings were issued. Cold-wave warnings were issued on the 11th for Louisiana, Arkansas, and the southern and extreme eastern portions of east Texas. These warnings were only partially verified because the high pressure moving eastward did not extend southward to the Gulf coast. Cold-wave warnings were issued on the 17th for Oklahoma, Arkansas, northern Louisiana, and the northern portion of eastern Texas, on account of an area of high pressure attended by cold weather over the Mississippi Valley and the Plains States which was expected to extend southward over the area covered by the warnings, but the high pressure did not move southward and the warnings failed of verification. Unseasonably warm weather prevailed over the district during the latter part of the month and the highest temperatures of record in February were recorded at several stations in the district.

Storm warnings were issued for the Louisiana coast on the 1st and for the Texas coast on the 4th and 11th, all of which were justified by subsequent conditions.

Fire-weather warnings were issued for Arkansas and Oklahoma on the 4th and 17th, and the winds forecast occurred.—*I. M. Cline, Forecaster.*

*Denver district.*—The first half of the month was marked by high pressure and low temperatures west of the Continental Divide. During the latter half stormy

weather with considerable snow followed by high winds prevailed in Utah and adjacent portions of Arizona.

At 8 p. m. on the 3d mild temperatures prevailed in eastern Colorado, while an area of high pressure was moving southward across eastern Montana and cold-wave warnings were issued for northeast Colorado. The warnings were verified in the eastern portion of the area. Cold-wave warnings were repeated the following morning for northeast Colorado and extended to southeast Colorado, and were verified, except near the foothills. Mild temperatures again prevailed in eastern Colorado at 8 p. m. on the 16th, with high winds and increasing pressure in parts of Wyoming, Montana, and the Dakotas, and cold-wave warnings were issued for eastern Colorado and repeated the following morning. These warnings were justified, except near the foothills. Heavy snowfall warnings for Utah, northern Arizona, and central and southwest Colorado were distributed at 11:30 a. m. on the 17th. During the 24 hours ending 8 a. m. on the 18th over 8 inches of snow fell at Flagstaff, Ariz.; 5.5 inches at Durango, Colo.; and 4 inches in Utah, while during the 36 hours ending at 8 p. m. on the 19th the snowfall at Flagstaff was over 11 inches, at Durango over 9 inches, and over 6 inches in parts of Utah. On the evening of the 19th a low-pressure area of decided intensity appeared to be moving inland from the north Pacific, and warnings of high winds were included in the forecasts for the northern portion of the district. Warnings of high winds were repeated on the 20th and 21st. High winds occurred in Utah, with temperatures above freezing, and reports indicate that snowslides occurred on several dates in portions of Utah and Arizona, impeding railroad traffic locally. On the evening of the 22d temperatures in eastern Colorado ranged from 50° to 60° F. At the same time the pressure was relatively high, with zero temperatures, in eastern Montana. The cold area appeared to be spreading southward along the eastern slope of the Rockies, and cold-wave warnings were issued for eastern Colorado. While temperatures fell 15 to 17 degrees, with temperatures below freezing on the morning of the 23d, the warnings were not verified, as a moderate area of low pressure crossed the mountains into eastern Colorado. Freezing-temperature warnings were issued for southeast Arizona on several dates, and freezing temperatures occurred. Cold-wave warnings were issued in the evening of the 25th and repeated the next morning for eastern Colorado. One low center moved southward, as expected, but the course of the HIGH from the northwest was too far eastward. Temperature falls of 20 degrees or more were common, but no low temperatures occurred.—*Frederick W. Brist, Assistant Forecaster.*

*Portland, Oreg., District.*—February, 1917, was not as stormy as usual in this district. From the 6th to the 15th, and again on the 27th and 28th, the weather was controlled by high pressure areas. North Pacific LOWS of slight to moderate energy were the dominating factors from the 1st to the 4th, and from the 18th to the 22d. A South Pacific LOW influenced the weather in Oregon and in portions of Washington and Idaho on the 24th and 25th.

Southeast storm warnings were ordered on the 1st at Washington coast stations and at the mouth of the Columbia River, and southwest storm warnings were ordered on the 15th at Washington stations and at the mouth of the Columbia. Both sets of warnings were verified. On the 19th a southwest storm warning was ordered at Marshfield. It is not known whether this

warning was verified or not, but it is believed it was. Small-craft warnings were issued on the 19th to all stations, and on the 24th to Marshfield and at the entrance of the Strait of Juan de Fuca.

Live-stock warnings were telegraphed to 25 distributing points on the 19th, 21st, and 24th to cover a period of rain and snow with blustering winds. These warnings were verified at nearly all places, and the following unsolicited letter relating to the first one was received from the Twin Falls Commercial Club:

You certainly called the turn in yesterday's forecast, for snow began falling here at 3.30 a. m. and it continued until 2 p. m., giving us a total fall of more than 6 inches.—*J. McMillan, Secretary.*

The official in charge of the Weather Bureau station at Walla Walla, Wash., states:

From information I have been able to gather, mainly through Forest Supervisor J. M. Schmitz, the warnings were quite fully verified on the stock ranges of this district. About 2 feet of snow fell at intervals in the mountains during the period from the 19th to the 24th, inclusive. There were, however, no severe storms. Gusty winds occurred frequently, but they did not attain a very high velocity, and no severe temperatures were experienced. There was no loss of stock.

In Oregon, where the lambing season begins earlier, some losses occurred in Benton County, and if any were

experienced elsewhere they were not reported.—*E. A. Beals, District Forecaster.*

*San Francisco District.*—Like the two preceding months, February opened fair and cold with killing frosts in all sections of California on the 1st and 2d, after which the weather moderated and no other injurious frosts occurred. Light rains occurred on the 11th in northern California, extending into southern California on the 12th. Rain began again in the north on the 16th, extending into southern California on the 17th and 18th. General rain began on the 18th and continued with but little interruption until the 26th. The forecast for rain on the 13th was not justified.

Northwest storm warnings were issued from Point Reyes to Eureka on the 16th, and advisory warnings were sent to the southern coast. Southwest warnings were issued from Port Harford to San Diego on the 17th, and from Point Reyes to Eureka on the 19th. Southeast warnings were issued from San Francisco to Eureka on the 21st, and again on the 23d, when they were extended to Santa Barbara and continued on the 24th. The warnings were all justified.—*G. H. Willson, District Forecaster.*